Affective Attribution and Performance on the Iowa Gambling Task

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Dale Shultz

The Ohio State University

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Project Advisors: Professor William A. Cunningham, Department of Psychology

Professor Hal R. Arkes, Department of Psychology

Abstract

This study examined how attribution of emotion influences decision making on the Iowa Gambling Task (IGT). People are believed to rely on subtle unconscious changes in emotion to switch their preference from the bad decks to the good decks on the IGT. The current study looked at how attributing emotion to an external source instead of the internal cues that are thought to be used in this task, influences performance on the IGT. All Participants were given a placebo before they began the IGT and they were told that it helps with measuring skin conductance. The control group was not given any more information while the experimental group participants were told that the placebo caused an increase in heart rate and respiration. Participants in the experimental condition were expected to perform worse on the task than the controls because they were expected to believe the affect that arises from performing the task is due to the placebo and thus ignore internal cues to move away from bad decks. The results were in the opposite direction of the predicted results and those who were in the experimental group learned faster than the control group.

Introduction

Affect has recently emerged as aiding the decisions people make. Finucane, Peters, and Slovic (2003) define affect as, "'goodness' or 'badness' (1) experienced as a feeling state (with or without consciousness) and (2) demarcating a positive or negative quality of a specific stimulus. Stimulus representations associated with affect can include external as well as internal representations (p. 328)." Affect as an aide in decision making received more attention by the psychology community in the second half of the twentieth century. The first step in the process of affect being seen as an aide in decision making was when people started viewing affect as an orientation mechanism to important stimuli. Simon (1967) suggested the importance of affect in learning and how it is used to direct people's attention to things they find important. In decision making the stimuli that receive the most attention are usually the stimuli that have the most weight when making decisions. So, in other words, the more affective a stimulus the more attention it will receive and the more likely the affective stimulus will influence a person's decision when compared to a neutral stimulus. Zajonc (1980) proposed that decision making is influenced more by affect than anything else. He argued that people choose things that they like and the main reason they buy a certain item is because they liked it. Recent research by Antonio Damasio has implicated affect as having more of an influence on the decisions people make.

Damasio was interested in studying patients with brain damage to the ventromedial prefrontal cortex (VMPFC). This interest stemmed from the case of Phineas Gage, who was a railroad foreman who survived a blast that shot a tamping iron through his skull. He seemed perfectly fine after the accident and soon went back to work. After awhile people started to notice that he had uncharacteristic emotional outbursts and was unable to make good social decisions. He was eventually fired from his job. Damasio, Grabowski, Frank, Galaburda, and

Damasio (1994) researched Gage's skull and determined that the area damaged by the iron involved the VMPFC. Eslinger and Damasio (1985) examined a patient with damage to his orbitofrontal cortex who they called EVR. He showed poor decision making with regard to his professional and social life. EVR was given tests ranging from IQ to memory tests. He performed average or above average on all the psychological tasks he was given. He even performed normally on social morality tasks, he knew what the social norms were, but failed to actually abide by these in real life situations. Bechara, Damasio, Damasio, and Anderson (1994) designed a task they called the Iowa Gambling Task (IGT) that measures uncertainty in decision making. This task is supposed to imitate real life decision making. The task measures long term rewards/losses and short term reward/losses, and the goal is to choose more from the decks that have high long term rewards and small long term losses by the end of the task. He had people with brain damage to the VMPFC, controls with brain damage to other areas of the brain, and normal controls perform the IGT. The patients with brain damage to the VMPFC performed worse on the IGT than the control groups. Control groups eventually moved away from the decks that had bad payoffs and toward the better paying decks, but the VMPFC patients continued to select from the bad decks. This task showed that VMPFC patients who have their rational brains intact did not switch their preference from the bad decks to the good decks. Bechara , Tranel, Damasio, and Damasio (1997) had people perform the IGT while their skin conductance responses (SCRs) were measured. He wanted to examine whether or not there is some function before conscious reasoning that directs people away from the bad decks and toward the good decks. He found that both VMPFC patients and controls developed SCRs after gaining and losing money. He also noticed that controls developed anticipatory SCRs before selecting from decks, whereas VMPFC patients failed to develop these responses. The anticipatory SCR

findings are seen as being an affective response to the decks and they help guide behavior away from bad decks and toward good decks. This evidence was incorporated into Damasio's Somatic Marker Hypothesis (SMH).

Damasio (1996) hypothesized that people use affect to reduce the amount of choices to evaluate and help guide people toward decisions that are associated with a positive somatic marker. Damasio (1996) explains that people have initial experiences with outcomes of choices they make. These outcomes and how they made a person feel and its associated physiological response are encoded into somatic markers. When the person encounters similar situations he/she brings forth these somatic markers and if the marker is associated with a negative affective state then the less likely he/she will make the same choice in the new situation. The somatic markers and the emotions associated with the markers are believed to be linked in the VMPFC. Damasio (1994) proposed that there are two routes in which somatic markers can be activated, the as-if loops and the body-loops. The body-loop is the route theorized to be used during the IGT, and it is when the somatic marker reactivates the same physiological arousal that occurred during the formation of the marker. The as-if loop is when the somatic only reactivates the somatosensory cortex's representation of the body, and actual physiological arousal is not activated. In the IGT people experience increase in SCRs to the rewards and losses at the beginning of the task, these responses become encoded as somatic markers. Soon people are able to recall the markers and reconstitute that body state when they are deciding what card decks to select from, and these markers are manifested as anticipatory SCRs. According to Bechara, Tranel, Damasio, H., and Damasio, A.R. (1997) people were unaware of any good or bad decks when they started to show theses anticipatory responses and preference for the advantageous decks. By the time people have made it about half way through the task they have some hunch as to what decks are good

and bad. This phase is associated with even more selections from the good decks. Maybe there is some cognition needed to help make the switch from the bad decks to the good decks.

People's cognitions may actually be used to scan their environments for causes of increased affective arousal, and people determine how they feel depending on what results these searches yield. Lazarus (1984) argues that emotions are a result of how people cognitively appraise their situation. People have an increase in affect and search their environment for a reason for the increased affect. The cognitive evaluation of the situation determines how the increased affect is appraised and how it is appraised determines the emotion that is elicited. Schachter and Singer (1962) developed the two-factor theory of emotion which was one of the first looks at appraisal theory. Participants were given a shot of epinephrine that was explained as being a vitamin supplement and that people would perform a vision test later in the experiment. Participants were told that the effects of epinephrine were associated with increased physiological arousal, or they were not told the side effects of the shot, or they were misinformed of the side effects of the shot and told that it caused numbness in the feet and itchiness. Participants were then placed in a waiting room with a confederate. In the waiting room they had to fill out a questionnaire. Confederates either acted euphoric, making paper airplanes, or angry, getting upset about the questions on the questionnaire. Participants told about the correct side effects of epinephrine acted in a normal manner, but people in both the misinformed and uninformed groups reported feeling happy when the confederate was euphoric or upset when the confederate was angry. Participants also started to imitate the behaviors of the confederate in both the uninformed and misinformed conditions. These results indicate that people use their cognition to interpret emotional arousal, so if people have an increase in their physiological state

and they have no explanation for why they are having this reaction, then they will look to the situation to determine what is causing that increase in affect.

Subsequent research has studied the appraisal theory by observing its influence in everyday day life. Dutton and Aron (1974) had an attractive female research assistant give a questionnaire to men who were alone and either crossing a 230 feet high suspension bridge over a canyon or a small bridge over a small creek. The questionnaire included some filler questions and the subjects then had to write a story about a picture, the stories were then measured for sexual content. Subjects were given the research assistant's phone number in case they wanted to talk about the study more. People on the high bridge had more sexual imagery in their stories and were more likely to call the research assistant than the subjects on the low bridge. This study further supports the notion that emotion is a result of cognition. Subjects on the high bridge were more likely to have increased arousal due to the height of the bridge and attribute this feeling to the being attracted to the female talking to them. Since the basic principle of appraisal theory is the use of cognition to interpret affective arousal, then it's possible to view this model within the framework of the SMH.

According to the SMH (1996) when people start to shift their preference from the bad decks to good decks, they are evaluating these somatic markers and comparing the current situation with past similar situations. If the current situation is compared to a bad situation and an associated level of affect, then a person will be less likely to behave in the same way that they did in the previous situation and vice versa. This evaluation process can be seen as an attribution because a person attributes the increased physiological arousal to the bad decks and then he/she learns to start avoiding those decks and pick more from the good decks. If people are using attributions to help them perform better on the IGT, then this process could be interrupted by

having people misattribute the cause of their increase in affect. The current study will investigate how performance on the IGT will be affected when people misattribute the cause of their increased physiological arousal to an external event rather than being caused by the bad card decks.

Participants in this study will all be given a placebo solution, and they will be told that it helps measure skin conductance. Participants who are given a solution and told that it increases heart rate and respiration, concepts associated with an increase in affect and physiological arousal, are expected to perform worse on the IGT than people who are not told that a placebo has side effects. This is expected because in the IGT people rely on their affect or somatic states that are activated by their somatic markers in response to the bad decks. If people believe that increases in affect are being caused by an external event instead of their internal reactions to the bad decks, then they are hypothesized to attribute their changes in affect to the external event rather than to the card decks and take longer to make the switch to the good card decks. Kadous (2001) had participants misattribute anxiety caused by negative outcomes of audit cases to anxiety that was explained as being caused by taking on the role of a juror and having to make difficult decisions. By attributing the anxiety to themselves instead of the bad outcome they were more likely to base their verdict on the quality of the audit rather than the negative outcome of evaluating blameworthiness of auditors. In the current study the performance difference is expected to be seen in the block of cards where anticipatory responses usually start to occur and participants are not yet aware of any bad or good cards. There should be no difference between groups in the beginning of the task because people randomly select from the different card decks. There is expected to be little differences later in the task because this is where people are able to conceptualize why the bad decks are bad and why the good decks are good. De Vries, Holland,

and Witteman (2008) used a method of separating the cards into different blocks when researching the influence of mood on IGT performance. They also expected the group differences to only be significant during the pre-hunch phase. The current study uses a computerized form of the IGT. Bechara, Damasio, H., Damasio, A.R., and Lee (1999) had participants designed a computerized form of the IGT and found that there was no difference between performance on that version and the actual card version that they used in the original study. To ensure participants were motivated to perform the task, they could win up to five dollars depending on how well they perform.

Methods

Participants and Design. One hundred participants enrolled in an introductory psychology course participated in the experiment for course credit and were paid up to five dollars depending on performance on the IGT. Some participants were excluded from the analyses. Twelve participants encountered occasional computer errors that prevented them from finishing the task, three participants decided not to participate in the study after learning the requirements, five participants did not believe the manipulation, and twenty-three participants failed to choose a card within the four seconds before the next set of cards were presented or their reaction times were too fast. After participants were dropped there were a total of fifty-seven participants. Twenty-two participants were in the experimental condition and the control condition consisted of thirty-five participants. The design of the experiment was a between participants design with two conditions. Participants in both the control and experimental group were told to drink a solution, a tonic water and water mixture that helps measure skin conductance. Participants that were in the control condition were given no further instructions. Participants in the experimental condition were told that the solution along with helping measure skin conductance caused a safe

increase in heart rate and respiration. The solution actually has no effect on measuring skin conductance nor does it increase heart rate or respiration.

Iowa Gambling Task. The IGT was programmed in E-Prime by the CCL lab at the University of Indiana. The IGT consists of four card decks labeled A, B, C, and D. Decks A and B are considered bad decks because every ten selections from these decks results in an overall negative value of 250 dollars. Selections from Deck A always yields a gain of 100 dollars, but on top of this 100 dollar gain participants will lose between 150 and 350 dollars five out of every ten selections. Deck B, on the other hand, has the same guaranteed 100 dollar reward as deck A, but instead of losing money half the time, every ten selections participants will lose 1250 dollars. The other two decks, C and D, are considered the good decks because after every ten selections from these decks incurs a gain of 250 dollars. Deck C and D have smaller immediate rewards than decks A and B; each selection always yields a 50 dollar gain. When participants choose from deck C they lose between 25 and 75 dollars on five out of every ten selections; although they still receive 50 dollars from selecting this deck. Participants selecting cards from deck D will lose 250 dollars after ten selections on top of gaining 50 dollars for choosing from that deck. All rewards are programmed to happen at a particular card selection and thus do not occur randomly. Cards are selected by participants pressing keys 1 through 4, 1 being for deck A on the left side of the screen, 2 for deck B, 3 for deck C, and 4 for deck D located on the far right side of the screen. Each card selection is present on the screen for four seconds. During this time participants are to choose a card or else the next set of cards will be presented and they will be penalized 100 dollars. The goal of the task is to win as much money as possible.

Procedure. The experiment was posted on the Research Experience Program (REP) website. People enrolled in Psychology 100 who were age 18 years or older were able to enroll in the

experiment. The experiment was described as being a study looking at physiological correlates of gambling performance. Participants received a half hour credit if they chose to participate in the thirty minute study. Participants were told that they would have their skin conductance measured via a sensor electrode on their hand. The experiments were open to a maximum of six participants at a time. Skin conductance was not actually measured. SCR electrodes were attached to the back to each of the six computer towers via electrical tape. The experiment was loaded onto each of the computers. The solution was comprised of half diet tonic water and half tap water and this solution was poured into paper cups. The solution was also prepared before participants entered to room for the experiment. The participants were instructed to wait in the Lazenby Basement waiting area until their names were called out. The participants then were lead to the lab. Upon entering the lab they were instructed to wash their hands, to increase the believability that the SCRs were going to be measured. Once everyone washed their hands they were told to sit down at a computer. Here they were presented with two consent forms, one for them to keep and one for them to sign and give back to the experimenter. At this point they were informed that they could win up to five dollars depending on how well they did on the gambling task. Before they signed the consent forms, they were told that they would have to drink a solution that aided in measuring skin conductance. The experimental group was also told that this solution also increased heart rate and respiration. There were a total of twenty-six sessions, thirteen control and thirteen experimental sessions. Participants who agreed to drink the solution signed the consent form and turned in one copy to the experimenter before beginning the study. Participants were then handed the paper cup with the solution and were told to drink the solution before the skin conductance sensor electrodes could be attached to their hands. After they drank the solution the sensor electrodes were attached to their right hands. The computer displayed the

instructions on how to perform the task. Participants were asked to read the instructions and then asked if they all understood the instructions. Participants were then instructed to press the enter key once they read and understood the instructions. All the people started with a credit of 2000 dollars, not real currency, at the beginning of the task. The task ended after 100 card selections, participants were not made aware of how many cards they would choose before they were done with the task. About one out of every ten participants experienced program errors at some point during the task and were not able to complete the task. After participants were done with the IGT a screen showed their final score. Once people were finished with the task a file was automatically created containing the data. The experimenter removed the SCR electrodes and then paid the participants money depending on their final score. The payment was determined from a pilot study that eighteen people took part in and the scores were averaged. Participants filled out funds reimbursement and receipt forms. Debriefing papers were handed out and participants were then free to leave the experiment.

Results

I hypothesized that participants would choose randomly from the four decks at the beginning of the task (cards 1-25), and for this reason I expected there to be no difference between groups until later in the task. Even though performance is expected to increase later in the task (cards 51-100), the effects of condition should occur in the second quartile (cards 26-50). This is the point where people typically learn to switch to the good decks, when anticipatory SCRs/ activation of somatic markers are thought to begin, but too early for people to be aware of any rules. Since this is where people are thought to start attributing the anticipatory SCRs to the bad decks, then people who have an incorrect explanation for arousal will likely not make the switch here. To test these a priori hypotheses, a 2 (condition) x 4(quartile) analysis of variance

(ANOVA; see Figure 1) was performed. There was a main effect of quartile showing that participants learned the task over time ($F(1,165) = 6.98$, $p<.001$; see Figure 1). Though, there was no main effect of condition ($F(1, 55) = 0.04$, p = ns) and there was no interaction of time by condition ($F(3, 165) = 1.49$), p = ns). The misattribution manipulation may not have influenced learning.

Additional analyses were performed on cards 26-50, because of the a priori prediction that the biggest difference would be seen here. During this block participants in the control group chose correctly 46.63% of the time (SD = 10.54, range 20-68). As predicted, the experimental group picked from the good decks 44.63% of the time (SD = 13, range 20-68). Although this was in the anticipated direction, the effect was not significant ($t(56) = 0.91$, $p = .4737$).

Because the blocks of trial were divided into four blocks, I examined whether the predicted slopes were different between the two conditions. For each participant, I examined the relationship between trial as a continuous variable and whether the participant made the correct selection. So, the larger the slope the more a participant learned. I performed a logistic regression analysis to analyze correct selections for each of the participants. On average, participants made correct answers as they progressed through the task ($F(1, 56) = 28.71$, $p < .0001$: mean slope . 127). Again, there was no effect of condition ($F(1, 56) = 2.21$, p =ns), but now there was an interaction between trial number and condition ($F(1, 56) = 5.79$, p ¸.05). Comparing the slopes showed that participants in the experimental condition had larger slopes than participants in the control condition (.07; see Figure 2). This was in the opposite of the prediction.

Discussion

The results replicated previous findings by (Bechara, Damasio, A., Damasio, H., and Anderson (1994), Bechara, Tranel, Damasio, and Damasio (1997), Bechara, Damasio, Damasio,

and Lee (1999), Bechara, Tranel, and Damasio (2000)) that people, without damage to the VMPFC, learn to switch their preference from the bad decks to the good decks as they progress through the IGT. The conditions were compared at Block 2 and there were no significant differences between performances at this block. The original hypothesis stated that performance would decrease on the IGT for participants if they attributed affective arousal to an external source. This performance reduction was expected to be seen around card twenty-five, when people start to show anticipatory SCRs. This was because participants were expected to attribute the anticipatory SCRs to the bad decks. The differences were expected to be smaller in cards 51 through 100, due to both groups being able to conceptualize the goodness and badness of each deck around this point. Results showed this was not the case and participants in the experimental condition started to do better than the control group around card 50. These results are after people had to be dropped from analyses due to computer errors, not following instructions, or not believing the manipulation. Possibly more participants should be run to make sure that these results are not due to sampling error. The results may implicate another process involved in the IGT instead of the proposed attributional one. A new hypothesis could look at the possibility of attention processes in the IGT and there are two ways the manipulation could have increased attention in the experimental group.

The first possible explanation for these results is the experimental manipulation served as a priming mechanism. By telling people that a solution increased heart rate and respiration they could have become more aware of their physiological state. This explanation has been seen in studies like Schwarz and Clore (1983), where participants were not aware of how the bad weather was influencing their mood until the weather was mentioned to them. The activity of the autonomic nervous system is usually below people's awareness and is ignored until it becomes

activated above a certain point, or people are told to monitor their breathing or heart rate. This activation of one's body state could increase monitoring of his/her physiological arousal during the IGT. As participants win and lose money they may become more sensitive to the rise in affect that is associated with the consequences of each deck. Participants may also be more sensitive to the anticipatory responses that occur later in the task, but a bigger difference would be expected during Block 2 where anticipatory SCRs begin to occur. A possible way to test this interpretation would be to add a third condition where participants are told that the solution does not have any side effects and should not create any physiological arousal. If telling people about heart rate and respiration makes them aware of their bodily state, then telling people that there would not be any increase in things like heart rate and respiration would still make them think about their autonomic activity. In this possible experiment, there would be no expected difference between the condition where people are told of possible side effects and the condition where people are specifically told that there are no side effects dealing with heart rate and respiration.

There is also a possibility that people believed that the solution actually increased physiological arousal and this influenced their performance on the IGT. The increase in arousal may have also helped participants monitor their physiological state more easily and this allowed for them to notice what cards were bad and make the shift to the good decks faster than the control group. One simple way to test this new hypothesis would be to measure physiological activation by monitoring heart rate variability and skin conductance. If there is simply more activation in the experimental group then this could be better supported. A combination of heart rate measures and a third condition where participants are specifically told that a solution does not affect heart rate or respiration could be a follow up study. In this new study there would be

an expected increase in physiological activity in the condition where participants are told about side effects, but no difference between the autonomic activation in the control condition and the condition in which participants are told that there are no side effects. The performance on the IGT would still be expected to remain higher in condition where side effects are expected compared to the other two conditions. The results could have also been due to certain expectations.

The results may be due to demand characteristics resulting in a negative participant role by the experimental group. Participants in the experimental group may have doubted the manipulation or at some point in the experiment noticed no difference in their physiological arousal. This skepticism could have lead to participants paying more attention to the task and possibly be a reason for increased performance during the second half of the experiment. This was partially checked for by asking participants in the experimental group if they believed that there was an increase in heart rate and respiration due to the solution. Those who said that they did not believe the manipulation at all were removed from the data analysis. This may not account for people who doubted the experiment, but they were not fully cognizant of this doubt and not fully able to explain it. This possibility would be hard to verify, but we could ask some questions that relate the how physiologically aroused they feel after every ten card selections. These questions would also have to be designed as to not influence the participant's knowledge of the hypothesis and lead to new expectancy biases. This manipulation may not actually be feasible, but if such a questionnaire was possible, then one would expect a decrease in the believability that the solution caused an increase in physiological arousal in the second half of the experiment.

The experimenter may also have subconsciously communicated the expectation that participants in the experiment should perform poorly on the task and thus the participants tried harder on the task to prove the experimenter wrong. This possibility would be easily be checked by designing the experiment to be a double-blind study. This could be helped by making the experimenter unaware of the purpose of the study and what the hypothesis is for performance on the IGT is for the conditions. Also instructions regarding the effects of the solution could be presented on the computer instead of being read by the experimenter.

The results of this study provide interesting implications and directions for further research on misattribution and decision making. The proposed interpretations could still fit in the framework of attribution and the SMH because if a person has increased attention to their physiological state then he/she might have a better ability to label a deck as bad when attributing the bad deck to the arousal. The conclusion that people may be aware of internal affective changes that result from the IGT would implicate that paying attention to one's affective responses to a situation may help move that person in the direction of making a good decision. Since the interpretations of the results indicate that participants did not actually misattribute their affect, a new study should be designed to try to manipulate misattribution in a better way. Kadous (2001) showed that telling participants that it's natural to feel anxious being placed in the position of a juror actually had participants misattribute the negative feelings caused by the negative outcomes of an audit to themselves. Something similar could be used to manipulate how people make attributions.

The IGT has also received a fair amount of criticism over the past few years. Dunn, Dalgleish, and Lawrence (2006) reviewed research using the IGT since it was first used and they have found possible issues with its design. Future studies might look at performance on the

Soochow Gambling Task (SGT) instead of the IGT. Chiu et al. (2008) designed the SGT to show that people are guided by gain-loss frequency instead of expected value. They switch the deck values to have higher gain-loss frequencies for the bad decks and lower gain-loss frequencies for the good decks. The results showed that participants preferred the decks with worse expected value over the decks with the higher expected value. Until the validity of the IGT with regard to what good decision making is discerned, no solid conclusions can be made about the results of this study.

Figure 1

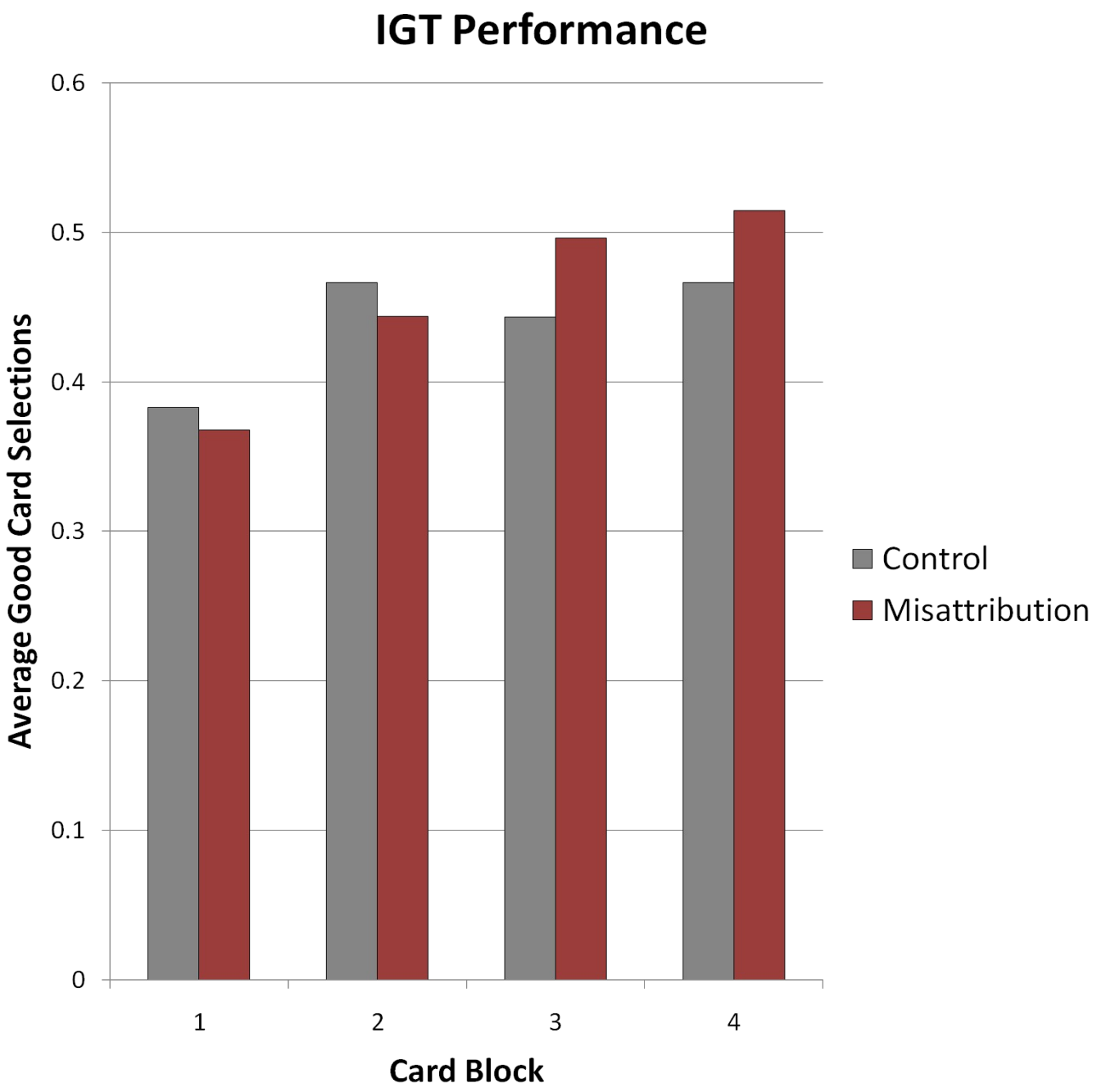
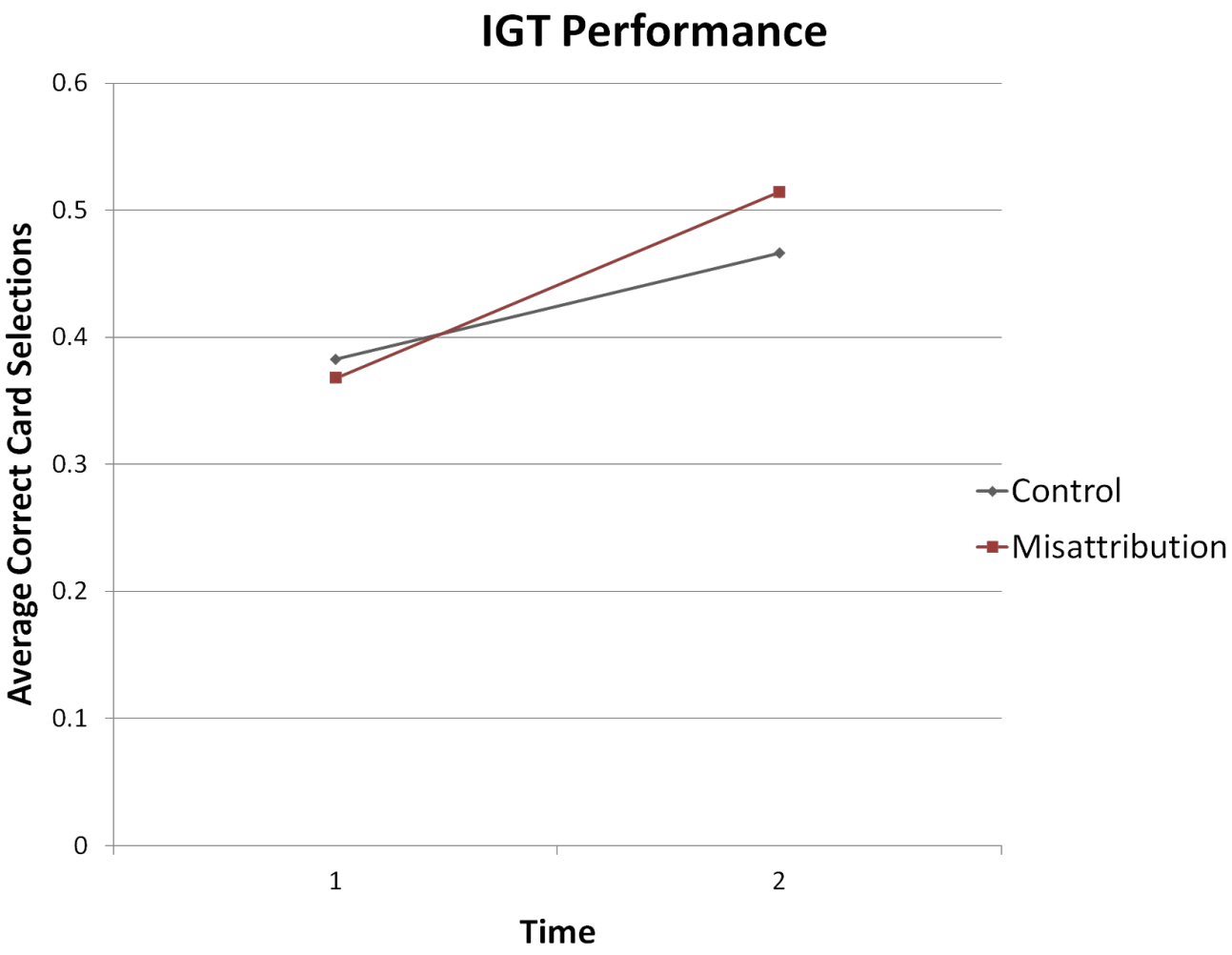

IGT Performance
Average Good Card Selections
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
Card Block
Control
Misattribution

Figure 2


IGT Performance
Average Correct Card Selections
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
Time
Control
Misattribution

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